

On the biology and voice of the Javan Scops Owl *Otus angelinae*

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The Javan Scops Owl *Otus angelinae* described by O. Finsch in 1912 is an endemic of Java. It is apparently rare as there are only ten specimens in museum collections, i.e. eight specimens in the Leiden Museum (NNM), including the type collected by M. E. G. Bartels Sr. on Mt Pangrango, and two in the Bogor Museum (ZMB); one from Cibodas, the other from Ijen, eastern Java. It is so far known only from two localities (Mt Pangrango/Gede and Mt Tangkubanperahu) in western Java, and one locality in eastern Java. About its biology very little is known. Andrew & Milton (1988) reported an observation of two fledglings of this species encountered on the NNE slope of Mt Pangrango in February 1985, but the adults were not seen.

There have been widely divergent opinions on the taxonomic status and relationships of *O. angelinae*, especially as its voice is unknown. G. P. Hekstra (in Burton 1973) regarded it as conspecific with *O. spilocephalus*, which ranges from the Himalayas to Taiwan and Sumatra; Sibley & Monroe (1990) also mention that as a possibility. Its relationship with *O. brookii* (Sharpe 1892) has been confused by the belief that *brookii*, a montane species occurring in Borneo and Sumatra, also occurs on Java. However, a re-examination of the unique specimen (collected in March 1916 in the Ijen Highlands, eastern Java; MZB 11752) on which its supposed occurrence in Java has been based, shows that it was misidentified and is in fact a specimen of *O. angelinae*. *Otus angelinae* is therefore almost certainly the only montane scops owl in Java, and a Javan endemic. A full discussion of its taxonomy will be given in a separate paper. In view of its very restricted distribution and its unknown status, it is listed as threatened in the recent ICBP *World Checklist of Threatened Birds* (Collar & Andrew 1988).

In July 1990, returning in the early evening from the summit of Mt Gede/Pangrango (3019 m), being at about 1500–1600 m and heading towards the Cibodas Mountain Garden, my attention was drawn to a hissing sound. This proved to be the contact call of two fledglings of the Javan Scops Owl. Taking advantage of the opportunity to study this uncommon species, I camped nearby and studied the owls for about 2½ weeks with a short interruption of a few days. The observations made during this period and some additional records of this owl at other localities are the subject of this paper.

(Frontispiece) Javan Scops Owl *Otus angelinae* in daytime roost in dense, entangled vegetation of stems of *Cyrtandra picta* (Gesneriaceae) at low level (1.20 m). Cibereum waterfalls, Mt Gede/Pangrango, 1900 m, 14 July 1991.

Photo: Manuel Ruedi (Univ. Lausanne).

Methods

The owls were studied for 17 consecutive nights (2–18 July 1990) with a short absence on four nights. The number of hours spent for observation varied per evening, in the beginning short, and later longer. When the birds allowed it, I usually observed a maximum of 4–5 hrs per night. On some nights, however, hardly any observations could be made due to heavy rain. Because of these adverse conditions, care was taken not to disturb the feedings of the young. At first the adult owls were very shy and much frightened by torchlight, and refused to approach the young when I was in the neighbourhood. For these reasons some adaptation time was necessary and I only gradually increased the period of observation till the maximum of 4–5 hrs was reached. Moonlit nights (in which torchlight was not needed) were especially favourable for observations. Considerable time was spent in obtaining voice recordings and some photographic documentation. Especially the latter was hard to achieve, because of the steep, broken terrain and luxuriant undergrowth.

Vocalizations were recorded with an Uher 4000 Report IC tape-recorder fitted with a Sennheiser directional microphone (Electrocondensator microphone type ME 88) at a tape speed of 19.5 cm/sec. The sounds were analysed with a Digital Sona-Graph 7800 (Dual Channel Spectrograph) connected with a Sona-Graph Printer 7900, both of Kay Elemetrics Co., Pine Brook, New Jersey, U.S.A.

Geographic names are according to *Atlas Indonesia* by I. Made Sandy (P. T. Dhasawarna & Jurusan Geografie FMIPA, Univ. Indonesia, ed. 6th, 1986). The coordinates given were calculated from survey-maps (1:50,000) of the Dutch East Indies Topographic Service.

The study area

The study site (06°45'S, 106°59'E) was virgin montane rain-forest of the Mt Gede/Pangrango National Park on the NNE slope of this twin volcano at an elevation of *c.* 1500–1600 m. The owls were encountered en route by using an alternative trail (to the east of the main trail) towards the Cibodas Mountain Garden. The site was about halfway between the Cibereum Falls and the Cibodas Mountain Garden. The virgin forest here had in the upper storey very large trees of *Altingia excelsa* (native name Rasamala, usually up to 40–55 m high and sometimes with a base diameter of 2.5 m), a number of oak species (e.g. *Quercus elegans*, *Q. pseudo-molucca*), chestnut trees (*Castanopsis argentea*, *C. tungurrut*), and figs (e.g. *Ficus involucrata*). During the observations the owls and owlets kept mainly to the middle and lower storeys of the forest. The vegetation at this level contained a wide diversity of trees, too many to list; among the commonest were *Villebrunnea rubescens*, two species of *Turpinia* (*T. pomiflora*, *T. sphaerocarpa*), *Saurauia pendula*, numerous *Eugenia* and *Litsea* species, *Euonymus javanicus*, *Ilex spicata*, *Olea javanica*, and *Pithecellobium montanum*. At ground level were numerous shrubs and herbs, certainly comprising many hundreds of species. Very conspicuous in this forest

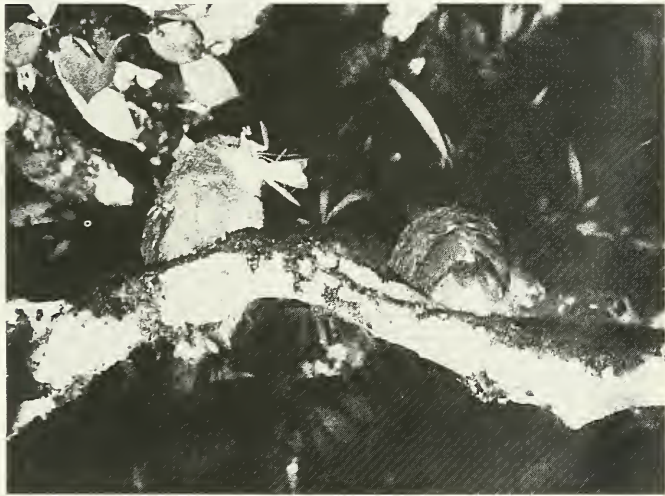


Plate 1. Upper. Active *Otus angelinae* photographed at night shows a round, rather puffed appearance and no ear tufts. It holds a praying mantid (*Hierodula flava*) diagonally between its mandibles.

Lower. *Otus angelinae* adult about to feed a praying mantid (*Hierodula flava*) to its offspring.

Mt Gede/Pangrango, 1600 m, July 1990.

Photo: J. H. Becking.

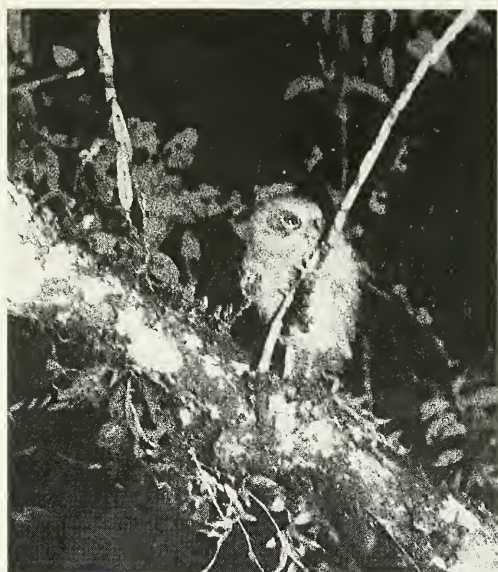


Plate 2. Young of *Otus angelinae*. The larger (upper) and the smaller young (lower) of the same brood.
Mt Gede/Pangrango, 1600 m, July 1990.

Photo: J. H. Becking.

type is the occurrence of numerous lianes, especially Vitaceae, and climbing rattan palms (*Calamus* and *Plectocomia* spp.) with long extended leaf rachides armed with vicious recurved thorns. Climbing pandans (*Pandanus lais*) and a small palm, *Pinanga kuhlii*, are abundant. The branches of trees are usually heavily overgrown with a wide variety of lichens and epiphytes such as orchids, ferns and mosses; epiphytic bird's nest ferns (*Asplenium nidus*) are especially common. The ground layer is thickly covered with dead, partly decomposed, leaves forming an excellent substrate for a wide variety of ferns and ginger species (*Amomum coccineum*, *Nicolaia solaris*). Plant lists and inventories of this montane rain-forest can be found in Koorders (1914, 1918–23), Seifrizz (1923), Meijer (1959) and Yamada (1990).

The climate is cool with an average day temperature of 17°C. In the study period the temperature gradually dropped at night, reaching a minimum of 9–11°C in the early morning (c. 5–6 a.m.). The average annual rainfall in this area is 3400 mm and the relative humidity inside the forest is always nearly 90%.

Field observations

Observations on 2–5 July 1990

On 2 July 1990 at 18.30 hrs, at the site detailed above, a hard *tsischschsch-tschschschsch* sound was heard. The hissing sound, repeated every 2–6 seconds, was audible at a distance of at least 40–50 m. When I approached the sound, the beam of my torch revealed two fledgling owlets perching close together (with body contact) on a thick bare bough about 4 m from the ground and 25 m from the trail. The owlets became restless and tried to escape from the light by fluttering to other branches with unhandy clambering movements using their claws and uneasy flapping of their wings. During these movements the yellowish markings on the outer vanes of the primaries and the yellow transverse bands on the underside of the spread tail were very conspicuous. Because of their awkward movements and fluffy appearance, it was obvious that they were fledglings. Their medium size, prominent whitish eyebrow streaks, a russet-brown face mask, and the yellowish markings on primaries and tail, indicated that they were *Otus angelinae*. No ear tufts could be detected. The underparts of the owlets appeared whitish, sparsely transversely barred or vermiculated over the breast with rufous bands of downy feathers. The breast feathers hardly showed the dark vertical blackish-brown shaft pattern known for the adults. The lower abdomen seemed to be nearly immaculate. The tail was very short and did not extend beyond the wings. The tarsi were closely feathered down to the toe-joint, and the toes appeared to be pale yellowish-flesh like the bills. In torchlight their eyes showed up as vivid reddish-brown (the wide open pupil) surrounded by an orange ring (the iris).

One fledgling was considerably larger than the other (Plate 2). It was noteworthy that whenever the fledglings were separated from each other by disturbance, as soon as this was over they tried to come together and often remained together in body contact with one another.

This behaviour continued during the whole fledgling period till they were nearly full-grown. Allopreening was, however, never seen.

The first night of observation (2/3 July) was a rather clear night with only some temporary fog and short periods of fine rain. Because the owls were rather shy and frightened by torchlight, I stationed myself at some distance in order to avoid disturbance or any interruption of the feedings. In complete darkness it was, however, easy to register the frequency of the feedings by the intensive begging and screaming calls of the young.

The owls were completely nocturnal as activity only started after dusk (18 hrs). At the beginning of the evening (c. 18.30–19.30 hrs) prey was brought to the two young about 2–4 times in 30 minutes. Between 19.30 and 21.00 hrs the feeding intervals were considerably longer and the young called less frequently and less intensively. After 21.00 hrs there were also periods in which the young were completely silent, and after 23.30 hrs no more calling was heard, although the owlets could still be spotted. As already mentioned, the adults were shy and frightened by the torchlight, and came to the young very reluctantly; in consequence, initially only a brief view of one of the adults could be obtained. This was only accidentally, as the adults were extremely active and alert and continuously changed their position. The short view was, however, sufficient to confirm their identity as *Otus angelinae*, as evident from the vivid golden-yellow iris, conspicuous white-frosted eyebrows, buffy collar on the hindneck, and rufous transversely vermiculated pattern with discrete vertical blotching of the central shafts of feathers on the ventral side. The head showed a prominent round rufous facial disc and the absence of ear tufts. Later observations of the adults showed a spherical, rather puffed appearance, a widely spread tail, and no trace of ear tufts (Plate 1). Because of the rather great distance at which these initial observations were made, no information could be obtained on the identity of the prey items.

The weather on the second night (3/4 July) was unfavourable with continuous rain, and I only succeeded in making some sound recordings of the contact call given by the young (Fig. 3), which was accompanied with a continuous rattle of splashing rain-drops on leaves, branches and microphone. However, the following night was exceptionally clear and fine. There was a nearly full moon and the owls could be spotted and regularly followed without the aid of torchlight. From these observations it became evident that the prey brought to the young were mainly large insects, such as beetles (seen as round objects), locusts, crickets, and large stick insects (only seen as long objects). Closer examination was not possible, because of the shyness of the adults and my fear for interrupting the feedings.

When one of the adults arrived with food the normal advertising call of the young, the continuously repeated *tsischschsch-tsischschsch* . . ., increased in pitch and turned into a sort of drawn-out wailing and screaming. Usually only one adult arrived at a perch near the young. However, in view of the sometimes extremely short intervals between successive feedings and the occasional observation of two adults arriving at the same time, of which one waited while the other delivered

the food, it was clear that both adults were involved in the feeding process. During this clear night, moreover, two new observations were made. First, when I approached the young in the dark, the adult on a perch gave an explosive and startling disyllabic hoot, *pooo-poo* (Fig. 2A). This call was uttered initially in a rapidly repeated series of 5–6 hoots in half a minute. It seemed to act as an alarm call, produced when the adult was very excited and concerned for the safety of its young. On later occasions this call was again provoked under similar conditions, but was only repeated two or three times. Later on, the call was only very rarely heard, apparently because the owls had become used to my presence.

The second important observation made on this night was that the adults, in trying to lure the owlets away from me by offering the food at some distance, also produced the *tsischschsch-tsischschsch* hissing contact call. Previously I had been uncertain of this, because adults and young were mostly too close to each other to distinguish their voices. As will be discussed later, the sound produced by the adults is somewhat higher in pitch and sounds purer and less scratchy than that produced by the young.

During their attendance by the parents the young regularly moved around, probably following one of the parents, in a radius of 100–400 m from the original spot. As already indicated, after 21.30 hrs the hissing contact calls of the young were produced at longer intervals (once in 4–6 sec), and later in the night they finally gradually faded away. In the early morning (4–5 a.m.), however, there was always some revival in calling and of feeding sessions. With the approach of daylight the hissing calls of the young completely stopped, and without the calls to guide me, I was unable to trace the daytime roost of this pair and their young. I presume that they roosted on a thick limb or bird's-nest fern high up in a tree and were therefore invisible from below.

Later observations

This part of the study was conducted between 9 and 17 July, after an absence of four days. I was able to find the owlets again relatively easily by their hissing sounds during the night; they had moved 300–400 m from the original spot. At this age the size difference between the young was still apparent, but not so great as earlier. At the end of the observation period, nine days later, they appeared to be approximately equal in size; they were then apparently nearly full-grown. About at this age (and some days before), when disturbed by an intruder, the owlets made swaying body movements, sometimes also a curious bending of the body and a swaying of the lowered head.

Since the owlets as well as the adults had become more used to my presence, closer and more detailed observations could be made of the food offered to the young. The young usually beg in a prone posture with quivering wings, calling loudly. The adults generally dismember large prey items such as beetles and the larger winged insects before presenting parts of them to the young. This they do by transferring the prey from the bill to the feet, holding it in the claws, and pulling it to pieces. I could hear the elytra of beetles and wings and other parts of

these dismembered insects fall to the ground, but I could never recover them later, even after intensive search, owing to the luxuriance of the ground vegetation. Moreover, I never found ejected pellets, but this might have been expected because the owlets did not stay in one place very long and I did not find their daytime roost. When waiting on a thick limb for food the owlets tended to adopt a somewhat cryptic attitude by assuming a flattened posture along the main axis of the limb or branch.

Prey items

I could finally approach close enough to the owlets to be able to identify the prey items delivered by the adults by sight. Of 21 food deliveries which I could see at close quarters, 4 were large beetles (probably Cerambycidae and Lucanidae, see later), 8 were praying mantids (Mantidae), 1 a stick insect or walking stick (Pseudophasmatidae or Phasmidae), 5 large green long-horned grasshoppers or leaf grasshoppers (Tettigoniidae:Pseudophyllinae and Phaneropterinae), 3 crickets (Gryllidae) or mole crickets (Gryllotalpidae, *Gryllotalpa* sp.). The large percentage (38% of the food) of praying mantids was noteworthy; they are rather inconspicuous by day in such a forest, but are very active at night, making short flights from stem to stem. In doing so they may attract the attention of the owls. The main mantid species involved could be identified to species level; it was *Hierodula flava* (Mantidae:Mantinae) (Plate 1), a green species, rather common in Java. It was also collected near the site of observation as it was attracted by lamp light. At least six of the mantids were this species; one other was a grey-black spotted praying mantid, probably *Theopompa* or *Liturgusa* sp. (Mantidae:Liturgusinae), and one pure white species with a pointed head, a so-called flower mantid, very probably *Hymenopus coronatus* (Mantidae:Hymenopodinae). The Tettigoniid prey were probably *Holochlora* and *Mecopoda* spp. (Phaneropterinae); an apparently identical leaf- or sickle-grasshopper collected at the site was identified as *Holochlora venosa*. The beetles brought were about 2.0–3.5 cm in diameter. Even from a relatively short distance they were impossible to identify to species level as they did not protrude far enough from the beak. Probably they were species of Lucanidae (stag-beetles) and Scarabaeidae (scarab-beetles) as representatives of these groups were regularly seen flying and were trapped by lamp light near the site. A reddish stag-beetle, *Metopodontus cinnamomeus*, and a scarab-beetle, *Xylotrupes* sp., were swarming at that time. *Serrognathus gypaetus*, *Neolucanus laticollis* and *Dichodontus croesus* also occurred very regularly at the site.

With regard to the hunting technique, a few observations indicate that the prey is seized with the claws from a branch, stem, leaf, or even from the ground after the owl's attention is drawn to it by its movements. There was no indication that insects are caught in flight, because when beetles or other apparently suitable insects flew close to the owls, they were ignored. Tettigoniids, a regular prey, are rather sluggish insects, but at night the males tend to produce strident notes with a stridulating organ, which may attract the owls.

The food of the adults is evidently about the same as that offered to the young. Occasionally prey brought to the young was finally eaten by the adults themselves. Mr M. E. G. Bartels Sr. examined the stomach contents of 4 adult specimens of *Otus angelinae* collected by him on the SW side of Mt Pangrango/Gede. He found 3× (in 3 of the 4 birds) remains of Coleoptera, including once a large long-horned woodboring beetle (Cerambycidae); 2× earwigs (Dermaptera), especially conspicuous in the stomach contents by their hard, indigestible anal forceps (probably *Cranopygia marmoricrura*, a common species in montane forest); 1× parts of a large grasshopper (Orthoptera); and 1× remains of a small reptile or lizard. A young specimen of *O. angelinae* kept by him for 3 months in an aviary took very readily crickets (Gryllidae), when these were offered (M. E. G. Bartels, unpublished diary notes in NNM, Leiden).

Voice

Otus angelinae is generally a very silent owl. I never heard a male's advertising call. In several other encounters with it (see later), I only once at night heard its cat-like hissing call, but never the main call, which seems to be reserved for situations of great stress or alarm (see below). During my study of this pair with their young, four different calls were recorded from the adult owls, and three from the young.

Vocalizations of the adults

Contact call. A cat-like hissing *tch-tschschsch* (or *tsischschsch*), less scratchy, more tonal and usually of higher frequency (6.0–7.5 kHz) and longer duration (0.40–0.51 sec) than the contact call produced by the young (see Fig. 1 and compare with Fig. 3). It was given by the adults when approaching the young or trying to lure them away (see above). Several times both the contact calls of the young and those of the answering adults were recorded at the same time on tape showing clearly the difference in pitch.

Main call of the female. A very explosive and startling disyllabic *poou-pou* (Fig. 2A). The first note has a duration of 0.25 sec and shows a frequency modulation between 0.5–1.25 kHz; the second note is 0.23 sec with a modulation between 0.5–1.10 kHz. As shown in the sonagram the second note is always lower in pitch than the first note. The interval between the two notes is 0.32 sec. The call is so powerful that the sonograph produces three overtones reaching a level of 4 kHz with intermediate frequency intervals at about 2 and 3 kHz. This call was produced by the female as a kind of alarm call for defending and warning the young. It was sometimes given in a series of 5–6 two-note calls with intervals of a few seconds; on other occasions it was only repeated 3 or 4 times.

Main call of the male. A much lower and softer *hoo-hoo* (Fig. 2B). I assume that this was the male's call since in other owl species it is usual for the male's call to be lower-pitched than the female's (Cramp 1985, J. T. Marshall pers. comm.). This call was sometimes given during or after feeding the young, apparently as a warning or when danger

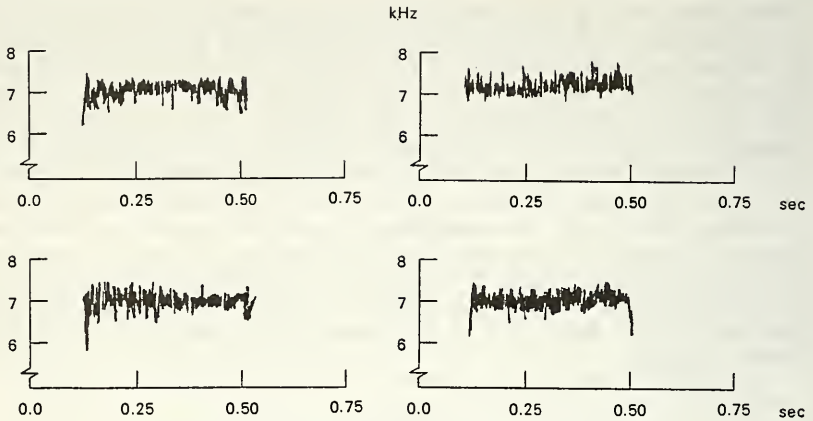


Figure 1. Sonograms of the contact call of the adults.

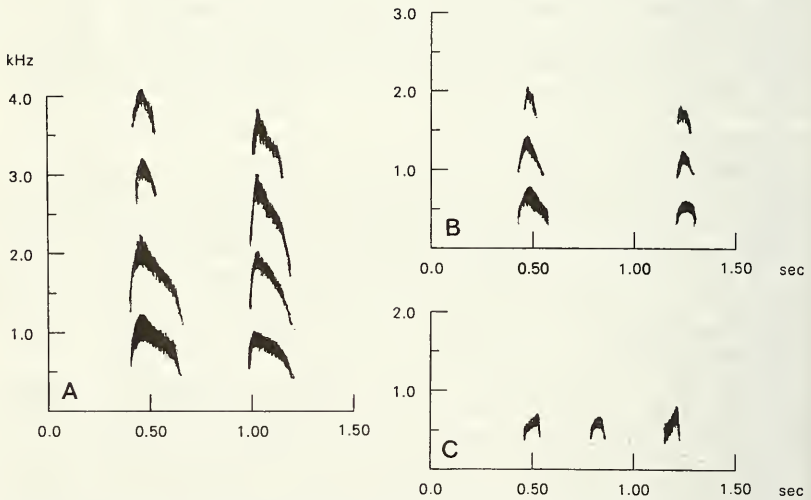


Figure 2. Sonograms of vocalizations of the adults. A, main call of female; B, main call of male; C, 'comfort call' of the male, when he comes to the young.

threatened. The male and female calls were never heard in association, i.e. as a duet. They were always uttered independently of each other on various occasions on different days, but in rather similar situations. The frequency range is between 0.25–0.75 kHz, the first and the second note have a duration of 0.18 and 0.10 sec, respectively; their interval is 0.60 sec. As evident from the sonogram it has the same structure as the main call of the female. The second note is usually lower in pitch than

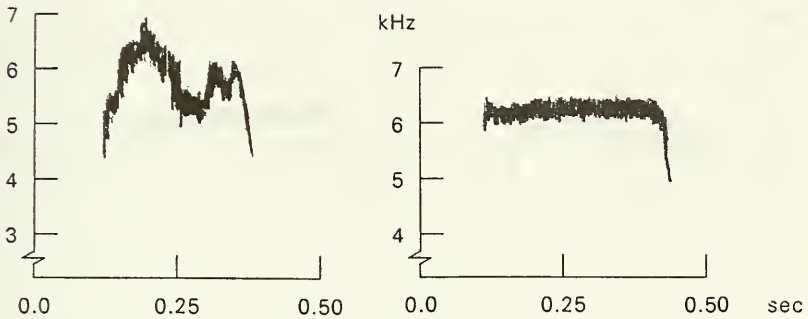


Figure 3. Sonograms of the contact call of the young of *Otus angelinae*. Left, 'scratchy'; right, more 'smooth'.

the first, but rarely may be of about the same pitch. The male call is, however, far less powerful and explosive than that of the female. Consequently, only two overtones are produced reaching to about 2.0 kHz.

Peace or comfort call. A low, soft *wook-wook-wook* (Fig. 2C). This call was sometimes uttered by the male during pauses in the feeding of the young or after feeding. Its frequency spectrum is between 0.3–0.75 kHz. The call lasts only 0.77 sec, and each note has a duration of 0.08–0.15 sec, with intervals of 0.3 sec.

Vocalizations of the young

Contact call. A hissing *tch-tschschsch* (or *tsischschsch*), of surprisingly constant duration (0.31 sec, very seldom a fraction longer). Its pitch and timbre, however, may vary. It is usually more or less scratchy, as apparent from the rather great frequency modulations in the sonagram (Fig. 3, left), but sometimes it can also be more tonal and therefore smooth (Fig. 3, right). Time measurements obtained from tape recordings made in the early evening (18.30 hrs) indicate that the contact call was repeated 16 times in 30 seconds giving an average interval of 1.9 sec between each phrase. The intervals between the calls were, however, irregular, ranging from 1 to 4 sec. As two fledglings were involved in this recording, the average interval between the calls of one bird is *c.* 4 sec. At about 21.00 hrs 10 calls were recorded for two fledglings in 30 seconds (average interval 6 sec per bird), and later in the evening the frequency of calling still further decreased, as already described. On one occasion when the fledglings were separated from each other, one of them called 14 times in one minute (at 20.15 hrs).

Food calls. When the young are approached by the parents to be fed, the contact call changes, usually gradually, into a screaming begging call, usually somewhat higher in pitch and of longer duration (usually 0.47–0.66 sec; Fig. 4). Sometimes, however, the begging calls are more prolonged (1.1–1.4 sec; Fig. 5), probably because the food is first dissected before it is offered to the young. During the feeding process

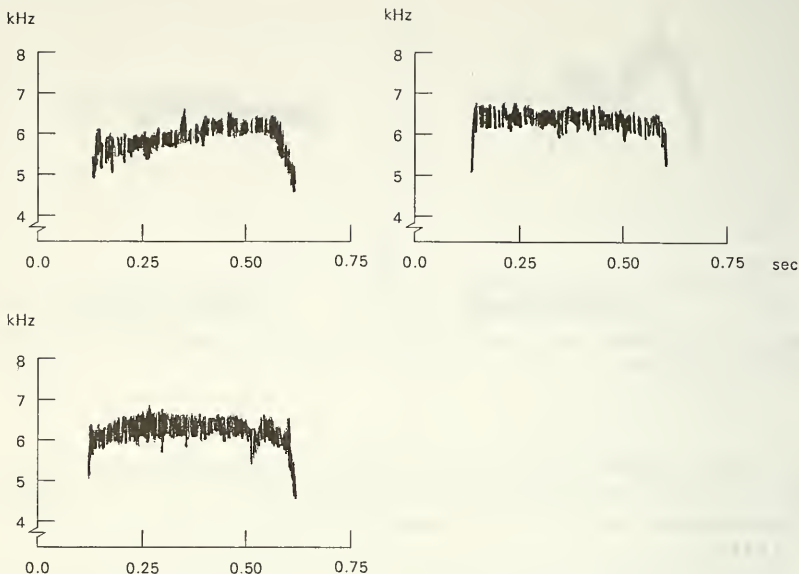


Figure 4. Sonograms of food calls of the young owlets.

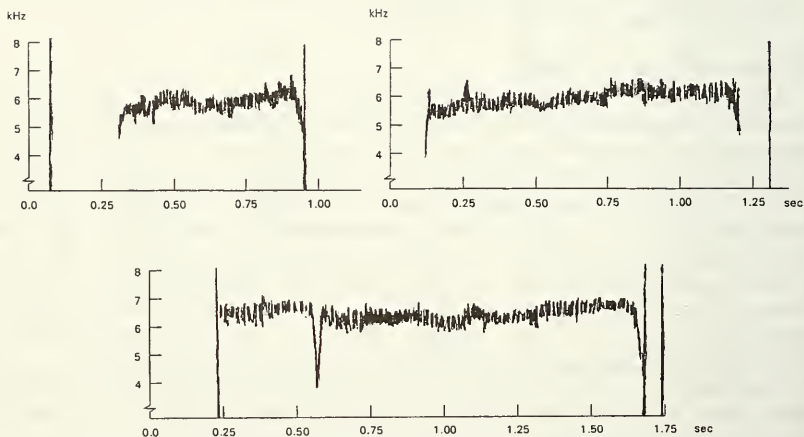


Figure 5. Sonograms of extended begging calls of the young, showing in addition bill-snapping (vertical lines) of the young.

and just before and after it, bill-snapping can often be heard. The bill-snaps are audible to the human ear as dry clicks and appear in the sonograms as vertical lines extending to c. 8 kHz (Fig. 5). Very probably the bill-snaps were produced only by the young, as

bill-snapping occurred only during feeding and more frequently when the young were very hungry, i.e. at the beginning of the evening. Under these conditions it may occur in rather rapid succession at intervals of 0.1–0.3 sec.

Twittering. A fast twittering or chittering *gick-gick-gick* is often produced by the young before and during feeding. It sounds rather similar to the twittering sound of young Barn Owls *Tyto alba* and some other owl species, also some swifts (e.g. *Hydrochous gigas*), when being fed.

Other records

Table 1 lists the localities, in order from west to east, from which *Otus angelinae* is known. Apart from the observation of Andrew & Milton (1988) and my observations discussed in this paper, all field records refer to single birds at daytime roosts or in places where they have perched after being disturbed. According to my experience the Javan Scops Owl usually perches with little concealment on a bare branch of a tree *c.* 3–5 m high, but occasionally much lower at *c.* 1–2 m above the ground (see Frontispiece). They apparently rely completely on their camouflage. Active birds at night never showed signs of ear tufts, but roosting birds by day exhibit very pronounced long ear-tufts, which they are able to raise vertically if they are aware of being watched or approached by man. In this concealing attitude, the so-called sleeked-upright posture, the body is stretched upward with feathers sleeked and half-closed eyes. In this tense posture their camouflage is very effective, and one may very easily pass these owls at close range without noticing them.

Breeding

There are three records of the breeding of *Otus angelinae*, all of recently fledged young; one on 4 February 1985 (Andrew & Milton 1988); one on 2 July 1990 (this paper); and a record of a recently fledged young brought to M. E. G. Bartels (Pasir Datar, SW slope Mt Pangrango) at the beginning July 1921, which was kept by him for 3 months in an aviary, before it died (25.9.1921, NNM 45836). Based on the incubation period (24–25 days) and the fledging period (average *c.* 25 days) of the Palearctic *Otus scops* of about the same weight and size (Koenig 1973, Cramp 1985), the approximate laying dates of the eggs of *O. angelinae* can be calculated. For the two July records the estimated laying date of the eggs is the 2nd week of May (*c.* 10–12 May) and for the February record the 2nd week of December (*c.* 12–14 Dec). These three records, however, do not justify a conclusion about a breeding season. There may be two peaks, one long season, or irregular breeding all year round. The size differences of the two young studied in this paper indicate asynchronous hatching, which is also known for other scops owls, including *Otus scops*, and for some other owl species. In the two *Otus angelinae* fledglings observed, I estimate that the egg-laying interval must be at least 3–4 days. The nest site of the owls

TABLE 1
Records of *Otus angelinae*

Locality	Altitude (m)	Dates	Collector/observer
Mt Salak (NNE slope, Ciapus valley, 6°41'S, 106°44'E)	c. 1200	Jul 1977 Oct 1987	J. H. Becking (sight records, single birds)
Mt Pangrango, SW slope (type-locality, 6°46'S, 106°56'E)	c. 1830	25.08.1911	M. E. G. Bartels (collected specimen)
Mt Pangrango, SW slope (type-locality, 6°46'S, 106°56'E)	c. 1830	20.09.1920	M. E. G. Bartels (collected specimen)
Mt Pangrango, SW slope (Pasir Datar, 6°50'S, 106°53'E)	1000–1500	24.04.1916 25.09.1921 24.07.1922 19.09.1926	M. E. G. Bartels (collected specimen) M. E. G. Bartels (collected specimen) M. E. G. Bartels (collected specimen) M. E. G. Bartels (collected specimen)
Mt Gede-Pangrango, NNE slope (Cibodas, 6°44'S, 106°59'E)	1450	1969–70	M. Toha (25–26 Nov 1969, 15–18 Dec 1970; 4 birds netted, 2 each year; one collected)
Mt. Gede-Pangrango, (Mt Gede-Pangrango National Park, 6°45'S, 107°00'E)	1500–1900	Oct 1971 Oct 1977 Jul 1983 4.02.1985 Jul 1990 Jul 1991	J. H. Becking (sight record, single bird) J. H. Becking (sight record, single bird) J. H. Becking (sight record, single bird) P. Andrew & G. R. Milton 1988 (sight record, 2 juveniles) J. H. Becking (sight record, present paper) J. H. Becking & M. Ruedi (sight record, single bird, see Frontispiece)
Mt Tangkubanperahu (NE slope, Ciater, 6°45'S, 107°37'E)	1800	1.11.1953	M. van Balgooy (collected specimen)
Mt Ceremay (W slope, Apuy, 6°45'S, 108°21'E)	1100	28.1.1930	J. J. Menden (collected specimen, ex collection H. C. Siebers)
Ijen Highlands (SE side, Soding Jerok, 8°07'S, 114°14'E)	1170	28.3.1916	H. C. Robinson & C. B. Kloss (collected specimen—formerly identified as <i>O. brookii</i>)

Note: Except Toha's specimen and the Ijen Highlands specimen which are in MZB (Bogor), all other collected specimens are in NNM (Leiden).